AGREEMENT

THIS AGREEMENT is entered into this _____ day of _____, 2010, by and between the City of Lincoln, Nebraska, a municipal corporation, hereinafter referred to as "City" and the Board of Regents, University of Nebraska, University of Nebraska-Lincoln, hereinafter collectively referred to as "UNL."

RECITALS

A.

The City proposes to engage UNL in accordance with the terns and conditions set forth herein to monitor pollutant loads from two watersheds within the City of Lincoln ("Development of Stormwater Discharge Pollutant Load Model for Holmes Lake Watershed - Year 4").

B.

UNL possesses certain skills, experience, education and competency to perform the Stormwater Discharge Pollutant Load Model on behalf of the City, and the City desires to engage UNL to conduct such Stormwater Discharge Pollutant Load Model on the terms herein provided.

C.

UNL hereby represents that UNL is willing and able to perform the Stormwater Discharge Pollutant Load Model in accordance with the Stormwater Discharge Pollutant Load Model proposal submitted with this Agreement.

NOW, THEREFORE, IN CONSIDERATION of the above Recitals and the mutual obligations of the parties hereto, the parties do agree as follows:

I.
EMPLOYMENT OF UNL

The City hereby agrees to employ UNL to perform. the Stormwater Discharge Pollutant Load Model and UNL hereby agrees to perform said Stormwater Discharge Pollutant Load Model. Said Stormwater Discharge Pollutant Load Model is more particularly set forth in those portions of UNL's Proposal dated September 2, 2010 described as "Development of Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed (Year 4)" attached hereto as Attachment A and incorporated by this reference.

II.
SCOPE OF SERVICES

UNL agrees to undertake, perform and complete in an expeditious, satisfactory and professional manner the Development of Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed services set forth in Attachment A on behalf of the City.

III.
TERMS OF AGREEMENT

The term of this Agreement shall commence January 1, 2011 through December 31, 2011, unless extended by agreement of both parties.

IV.
COMPENSATION

The City agrees to pay UNL for the services set forth in Attachment "A" a sum not to exceed Ninety Thousand Six Hundred Fourty-Two Dollars and no cents ($90,642.00). All payments will be made upon appropriate invoices to UNL and sent to Julie Poykko-Post, Office of Sponsored Programs, Alexander Building-West, 314 North 14th Street, PO Box 880430, Lincoln, NE 68588-0430.

Failure of the City to accept UNL's Stormwater Discharge Pollutant Load Model on the basis of differences of professional opinion shall not be the basis for rejection of the work performed by UNL or for nonpayment of UNL.

V.
SERVICES TO BE CONFIDENTIAL

The Parties acknowledge that it may be necessary to disclose information to the other Party that is considered proprietary or confidential ("Confidential Information"). If the provider of information considers the information as Confidential Information, it shall be identified as such in writing or marked "Confidential". If orally disclosed to or observed by the recipient, a description of the Confidential Information shall be reduced to writing by the provider, marked "Confidential," and delivered to recipient within thirty (30) days of disclosure.

The recipient of Confidential Information agrees to keep In confidence and not to disclose Confidential Information of the provider to any person outside the recipient's organization or to any unauthorized person within recipients organization and not to use providers Confidential Information for any purpose other than the performance of recipient's obligations under this Agreement, without the prior written approval of provider. Recipient acknowledges it will treat providers Confidential Information in a manner consistent with recipient's treatment of its own similar Confidential Information. However, the foregoing

limitations as to disclosure and use shall not apply to any portion of Confidential Information which:

(i) was in the possession of recipient before receipt from provider; or

(ii) is or becomes a mailer of public knowledge through no fault of recipient; or

(iii) is rightfully received by recipient from a third party without a duty of confidentiality; or

(iv) is disclosed by provider to a third party without a duty of confidentiality on the third party; or

(v) is independently developed by recipient and shown by documentation; or

(vi) is disclosed publicly under operation of law.

Each party retains the right to refuse to accept any Confidential Information which is not considered to be essential to the completion of the Research.

Recipient shall not disclose or otherwise use Confidential Information disclosed under this Agreement for a period of five (5) years from the date of expiration or termination of this Agreement.

Upon request of provider, recipient shall return or destroy all Confidential Information. However, recipient may retain one (1) copy for archival purposes and to confirm compliance with this Agreement.

VI.
TERMINATION OF AGREEMENT

Both parties may terminate this Agreement, in whole or part, for any reason for their own convenience upon at least ten days written notice.

If the Agreement is terminated by the City, UNL shall be paid for all services performed, non-cancellable obligations and reimbursable expenses incurred, not to exceed the above-mentioned Agreement amounts, up until the date of termination.

UNL hereby expressly waives any and all claims for damages or compensation arising under this Agreement except as set forth in this paragraph in the event of termination.

In the event of such termination, UNL agrees that all work performed and all confidential information as described in Section V provided by UNL to the City or by the City to UNL shall

remain confidential and shall not be provided to any person, firm, association or corporation without the consent of the City.

VII.
EQUAL EMPLOYMENT AND FAIR LABOR PRACTICES

In connection with the performance of work under this Agreement, UNL agrees that it shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, disability, national origin, age or marital status. In the employment of persons, UNL shall fully comply with the provisions of Chapter 11.08 of the Lincoln Municipal Code and shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex, disability, national origin, age or marital status. UNL shall maintain fair labor standards in the performance of this Agreement as required by Chapter 73, Nebraska Reissue Revised Statutes of 1943 (as amended).

VIII.
INTEREST OF UNL

UNL covenants that UNL presently has no interest, including but not limited to, other projects or independent contracts, and shall not acquire any such interest, direct or indirect, which would conflict in any manner or degree with the performance of the Stormwater Discharge Pollutant Load Model required to be performed under this Agreement. UNL further covenants that in the performance of this Agreement no person having any such interest shall be employed or retained by UNL under this Agreement.

IX.
INDEMNIFICATION

Each party shall be responsible for its negligent acts and omissions and the negligent acts or omissions of its employees, officers, or directors to the extent allowed by law.

X.
AUDIT PROVISION

UNL shall be subject to audit pursuant to Chapter 4.66 of the Lincoln Municipal Code and shall make available to a contract auditor, as defined therein, copies of all financial and performance related records and materials germane to this Agreement, as allowed by law.

XI.
INDEPENDENT CONTRACTOR

The City is interested only in the results produced by this Agreement. UNL has sole and exclusive charge and control of the manner and means of performance. UNL shall perform as an independent contractor and it is expressly understood and agreed that UNL is not an employee of

the City and is not entitled to any benefits to which City employees are entitled, including, but not limited to, overtime, retirement benefits, workmen's compensation benefits, sick leave or and injury leave.

XII.
NEBRASKA LAW

This Agreement shall be construed and interpreted according to the laws of the State of Nebraska.

XIII.
INTEGRATION

This Agreement represents the entire agreement between the parties and all prior negotiations and representations are hereby expressly excluded from this Agreement.

XIV.
AMENDMENT

This Agreement may be amended or modified only in writing signed by both the City and UNL.

XV.
CAPACITY

The undersigned person representing UNL does hereby agree and represent that he or she is legally capable to sign this Agreement and to lawfully bind UNL to this Agreement.

XVI.
SEVERABILITY

If any provision of this Agreement shall be held to be invalid or unenforceable for any reason, the remaining provisions shall continue to be valid and enforceable. If a court finds that any provision of this Agreement is invalid or unenforceable, but that by limiting such provision it would become valid and enforceable, then such provision shall be deemed to be written, construed, and enforced as so limited.

XVII.
WAIVER OF CONTRACTUAL RIGHT

The failure of either party to enforce any provision of this Agreement shall not be construed as a waiver or limitation of that party's right to subsequently enforce and compel strict compliance with every provision of this Agreement.

XVIII.
REPRESENTATIONS

Each party hereby certifies, represents and warrants to the other party that the execution of this Agreement is duly authorized and constitutes a legal, valid and binding obligation of said party.

IN WITNESS WHEREOF, UNL and the City do hereby execute this Agreement.

CITY OF LINCOLN, NEBRASKA

Attest:

_____ By: _____
Chris Beutler, Mayor of Lincoln

BOARD OF REGENTS
UNIVERSITY OF NEBRASKA-Lincoln

By: _____
Jeanne Wicks
Director, Office of Sponsored Programs

STATE OF NEBRASKA)
) ss.
COUNTY OF LANCASTER)

The foregoing instrument was acknowledged before me this _____ day of _____, 2010, by Chris Beutler, Mayor of the City of Lincoln, Nebraska, on behalf of the City of Lincoln, Nebraska.

_____
Notary Public

STATE OF NEBRASKA)
) ss.
COUNTY OF LANCASTER)

The foregoing instrument was acknowledged before me this _____ day of _____, 2010, by Jeanne Wicks. Director, Office of Sponsored Programs.

_____
Notary Public

ROJECT TITLE: **Development of Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed (Year 4)**

SUBMITTED TO:

Ben Higgins, Project Director
Engineering Services
Public Works
City of Lincoln
901 N. 6th St.
Lincoln, Nebraska 68508

APPLICANT INSTITUTION:

The University of Nebraska-Lincoln
312 N 14th Street
Alexander Building West
Lincoln, NE 68588-0430
Administrative Contact: Julie Poykko-Post
Ph: 402-472-6174 Email: jpoykkopost2@unl.edu

PROJECT PERIOD:

January 1, 2011 through December 31, 2011

AMOUNT REQUESTED

$90,642

PRINCIPAL INVESTIGATORS:

Bruce Dvorak, Professor
David Admiraal, Associate Professor,
Civil Engineering Department
W348 Nebraska Hall
University of Nebraska
Lincoln, Nebraska 68588-0531

Daniel Snow, Rsch Assoc Professor
202 WL Water Center
University of Nebraska–Lincoln
Lincoln NE 68583-0844

A Proposal for:

Development of Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed (Year 4)

Overview

The proposed work has two primary tasks. One is a study of two Lincoln urban watersheds and the other is a characterization Lincoln's dry weather storm drain discharges. The two tasks are discussed separately in this proposal.

The first proposed task is a joint study of two Lincoln urban watersheds. The study collaborators will be the University of Nebraska (UNL)-Civil Engineering, U.S. Geological Survey Nebraska Water Science Center (USGS), and City of Lincoln. The sampling sites for the two watersheds shall be in Taylor Park and Colonial Park. The study is intended to occur over a five year period (2008-2012). The study will focus on evaluating the value of best management practices (BMPs) that have been implemented in the Holmes Lake watershed to reduce sediment and nutrient loadings. Although this proposal discusses a five year project for the first task, this proposal is only for the fourth year. The budget is only for the fourth year of the project given that year-to-year funding will be provided.

The second task of the proposed work concerns dry weather storm drain discharge characterization. The monitoring of dry weather flows from storm drains is to provide a field screening analysis for illicit connections and illegal dumping for either selected field screening points, and major storm drain outfalls. Approximately 20% of the storm drain field sampling stations will be monitored during this period covered by this project.

Task One: Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed

Task One Objectives

The proposed project has two primary research objectives.

Objective 1: To estimate the pollutant loads from two watersheds within the City of Lincoln during non-winter periods.

Objective 2: To identify any differences in pollutant loads and yields from the two watersheds (Taylor Park and Colonial Park) and attempt to attribute those differences to the presence of BMPs within the Holmes Lake Watersheds.

Approach

The project is a joint endeavor between UNL-Civil Engineering, USGS, and the City of Lincoln. The proposed study will consist of both continuous and discrete monitoring of the storm water flow and water quality from two sampling sites in eastern Lincoln. The two sampling sites will be at locations agreed upon by the three parties (UNL-Civil Engineering, USGS, and the City of Lincoln). The data will be used to develop correlations between the continuous and discrete monitoring data to then make estimates for the pollutant loadings. Only the UNL components of the project are discussed in this proposal.

This study is intended to occur over a five year period (2008-2012), with the proposed work in this proposal for the 2011 calendar year. The fifth year will primarily involve data analysis and report

preparation. The equipment was installed in 2008 and the existing equipment will be used for this project year. Although the tasks listed in this proposal are for a five year study, the contracts will be set up on a year-by-year basis. The specific tasks performed by UNL are described subsequently.

Site Maintenance
UNL Civil Engineering will have a team of at least two students visit the two field sampling sites during the study period at least every two weeks to maintain the auto sampler, bubble stage monitor, and other flow monitoring equipment. When appropriate, the UNL students will obtain dry weather water quality samples and calibration stream flow data as part of the site maintenance visits.

Flow Measurement
UNL Civil Engineering will obtain and utilize data from the ISCO bubble stage monitors for continuous flow monitoring and other flow measurement devices for discrete flow monitoring to obtain and report flow volume data for the two sites and for the entire sampling period: from approximately March 1 through October 31, 2011. The details of the continuous and discrete flow monitoring are provided below.

Continuous Flow Measurement
ISCO bubble stage monitors will be used to continuously measure stage at both sampling sites. Stage-discharge relations will be used to convert stages measured with the stage monitors to volumetric discharges. Once calibrated, the stage monitors will provide a continuous record of volumetric discharge at the sampling sites for the entire sampling period. UNL Civil Engineering will maintain the stage monitors (installed with the autosamplers).

At each site, a rating curve that correlates stage to discharge must be determined. This will be accomplished by comparing stages measured with the stage monitors to simultaneous discharge measurements gathered with alternative calibration methods. For storm flows, an ISCO area-velocity meter will be used to calibrate the stage monitor. Additional measurements will be gathered with a miniature Acoustic Doppler Current Profiler in cooperation with the USGS to verify measured flows. For very low flows, the area-velocity sensor may not work, and a small weir or other calibration method may be used instead. A variety of manual calibration methods (e.g. using a large weir or direct velocity measurements) serve as potential backups in case the area-velocity sensor is damaged, but the manual methods will be avoided if possible because it is difficult to accurately measure discharge with them for the highly unsteady storm flows that are typical of such small watersheds.

Discrete Flow Measurement
An ISCO 2150 Area Velocity Logger will be moved from site to site as a way to develop stage-discharge relations for the bubble stage monitors. Since the Area Velocity Logger is installed in the manhole at Taylor Park, we will need to access the manhole at the upstream end of the culvert that empties into Taylor Park. The logger is mounted to the inside of the manhole and the sensor is mounted to the bed of the elliptical culvert. At Colonial Park, the Area Velocity Logger sensor is installed on a slab of concrete placed on the bed of the channel. The cable for the sensor passes through the same cable conduit as autosampler and stage monitor cables, and the logger is

installed inside the equipment station. We expect the city to help with seasonal installation and removal of the device. Because the Area Velocity Logger can only be used at one site at a time, and as a backup procedure in case the Area Velocity Logger becomes damaged, calibration of rating curves will also be done using manual depth-velocity sampling techniques and weirs. We prefer to avoid manual calibration as the sole method of calibrating the stage monitor rating curves because we think it will be less accurate in small watersheds.

Potentially, additional calibration measurements for low stream flows will be performed using conductivity measurements from the continuous monitoring probe using tracer techniques.

Continuous Water-Quality Sampling

With the City of Lincoln's help, the USGS will install and maintain continuous monitoring devices (probes) at both sites to provide continuous data on the following water quality parameters: temperature, turbidity, specific conductance and dissolved oxygen. These parameters will be used as surrogates for other water quality parameters analyzed through the discrete water quality sampling discussed below. The continuous water quality monitoring will occur from approximately March 1 through October 31, 2011. These data will be provided to UNL Civil Engineering.

Discrete Water-Quality Sampling

A series of water quality samples will be collected from both sites. Some of the samples will be collected to satisfy regulatory requirements for storm water sampling and other additional samples will be collected to compile "calibration" data sets to use to develop relationships with the surrogate water quality parameters collected from the continuous water quality sampling.

UNL Civil Engineering will have a team of at least two students visit the two field sampling sites during the study period to collect grab and composite samples for regulatory purposes from at least two measurable storm events of at least 3/8" of precipitation (referred to in Table 1 as "Regulatory Samples"). These samples will be collected in duplicate, thus four samples per site for the sampling season.

UNL Civil Engineering will have a team of at least two students visit the two field sampling sites during the study period immediately after at least four measurable rainfall events annually, with a total of approximately 32 samples collected from those events. All water quality samples will be obtained from the ISCO auto sampler and are referred to in Table 1 as "Discrete Storm Events". The storm events sampled will be representative of the range of storm event duration, intensity, and total rainfall for the year. The sampled storm events will be at least two weeks apart. An average of six samples from different parts of the storm hydrograph will be tested for each storm event.

UNL Civil Engineering will have a team to at least two students visit the two field sampling sites during the study period of approximately March 1 through October 31, 2011 about every three weeks to collect water quality samples from the dry weather flow (referred to in Table 1 as "Dry Weather Flows". An overall matrix of the frequency and type of parameters to be collected is provided below in Table 1 for 2011 sampling season.

Table 1. Proposed Sampling Frequency and Type of Water Quality Parameters to be Obtained during 2011 Sampling Season for each Site.

	Sample Type			
	Regulatory Samples	Regulatory Samples	Discrete Storm Events	Dry Weather
Sample Method:	Grab	Auto sampler / Composite	Auto sampler / Individual Aliquots	Grab
pH	4	4		10
Chlorine	4			10
Chloride			32	10
Total Copper			12	10
Surfactants				10
Fluoride				10
Nitrate	4	4	32	10
COD	4	4	32	10
Total Phosphorus		4	32	10
E. Coli	4		32	10
Total Suspended Solids	4	4	32	10
Turbidity	4		32	10
Conductivity			32	10
Dissolved Oxygen	4			10
Ammonia			32	10
TKN		4	32	10
Temperature,	4	4	32	10
Oil & Grease	4			

In addition, during this study, at least five grab samples for E. Coli and total suspended solids will be collected simultaneous to samples collected with the auto sampler at each site, for a total of ten grab samples. These samples will be collected from a combination of at least three storm events and from at least two dry weather flow sampling visits. These samples will be tested to determine if the similarity of results is sufficient to primarily use the auto sampler samples for estimating the pollutant concentrations for this research. The total suspended solids samples collected will be tested for both total suspended solids and for suspended sediment concentration (SSC).

Isotope testing performed during the 2010 sampling season suggested that these hold potential for helping characterize source material (e.g., lawn fertilizer runoff) for nutrients in the water samples. Additional isotope data will be collected in 2011. Approximately 12 water samples from each site will be tested for ^{18}O for nitrate and phosphate and ^{15}N of nitrate using high temperature pyrolysis coupled with isotope ratio mass spectrometry (IRMS) for oxygen isotope analysis of nitrate and phosphate (costing approximately $50 each) and steam distillation – oxidation and dual inlet IRMS for 15N analysis (costing $100 each). An additional twelve samples will be tested from source material (e.g., lawn fertilizer runoff) to help characterize sources. This is a test performed by the UNL Water Sciences laboratory to analyze the oxygen and nitrogen isotope composition for

nitrate and phosphorus, using the fact that specific isotope signatures are more common from certain sources. This testing offers the potential to differentiate sources of the nitrate and phosphorus in the storm water. This testing should be considered a pilot test to determine if sufficiently distinct isotope signatures occur to permit characterization of sources. Oxygen-18 analysis of run-off water and baseflow will be determined in a small group of samples to help with interpretation of the oxygen isotope analysis of the nutrients. Results in the technical literature for the use of this methodology are mixed, depending upon the water and pollutant sources. Based upon the results from this testing, additional testing may be suggested for future years.

Sample Collection

Samples and measurements taken as required shall be representative of the discharge. Samples to be tested for "regulatory purposes" shall be sampled in accordance with the requirements in 40 CFR 122. All samples shall be taken at the monitoring points specified.

a. Composite sampling shall be conducted in one of the following manners:
   (1) less than 24 hours - a minimum of hourly discrete aliquots or a continuously drawn sample shall be collected during the discharge, or
   (2) batch discharge - a minimum of three discrete aliquots shall be collected during each discharge.
b. Composite samples shall be collected in one of the following manners:
   (1) the volume of each aliquot must be proportional to either the waste stream flow at the time of sampling or the total waste stream flow since collection of the previous aliquot,
   (2) a number of equal volume aliquots taken at varying time intervals in proportion to flow, and
   (3) a sample continuously collected in proportion to flow.
c. Grab samples shall consist of a single aliquot collected over a time period not exceeding 15 minutes. Grab samples collected for "regulatory purposes" shall be collected during the initial flush of the discharge
d. Individual aliquots will be collected from storm events for non-regulatory purposes to expand the sample size for modeling purposes. These individual aliquots will be collected from a specific point in time using the autosampler.

Sampling Equipment

Composite sampling equipment (ISCO auto samplers) will be supplied and installed at the sites by the City. UNL shall be responsible for maintaining the monitoring equipment and associated appurtenances at the three urban runoff sampling locations. UNL shall also be responsible for maintaining the auto samplers, lines, bottles and batteries. Samples will be collected using dedicated sample bottles. Bacterial samples will be collected in dedicated bottles. Sampling personnel will be equipped with proper rain gear, boots, and rubber gloves. Sample bags will be stored in ice chests until they can be transferred to refrigerators in the UNL lab.

Sample Handling
Sample containers will be placed in coolers loaded with ice and transported immediately to the UNL lab where they will be stored in refrigerators until analyses are conducted. Sample containers will be labeled according to sample location and time of sampling. Standard Chain of Custody forms will be maintained for each sample collected. The Chain of Custody forms will include date, time, location, sample location number, sample identification number, analyses to be conducted, name and signature of sampler.

Discrete Water-Quality Sampling: Analytical Plan
The analyses listed in Table 1 will be performed by University of Nebraska-Lincoln on water samples collected from each field site with flowing water. Nitrate-N, ammonia, TKN, phosphate, and total phosphorus may be performed by the UNL Water Sciences Laboratory. E. Coli and total copper analysis may be performed by the Nebraska Department of Health and Human Services System Public Health lab.

Methods
The following analytical methods will be used for each analysis. The UNL Civil Engineering laboratory facilities will be used unless otherwise specified. Prior to analysis, samples will be stored at 4°C. Other preservatives used are noted in the description of the analytical method for that parameter.

pH
The solution pH will be measured in the field using pocket pH meters by Hach and tested in the lab within 6 hours of sample collection. The pH meters are capable of measuring to the nearest 0.1 pH units, with a precision of about 0.2 pH units.

Chlorine
Will be tested using Hach Method 8167 (which is the consistent with Std. Method 4500). This will be tested on-site.

Chloride
Will be tested using Hach Method 8113. The maximum holding time will be 7 days.

Total Copper
Will be tested using (Standard) Methods 3030 for the Examination of Water and Wastewater (Standard Methods) with Atomic Absorption. Samples will be immediately acidified. Samples with particulate will be digested. The maximum holding time will be 3 months.

Surfactants
Will be tested using Hach Method 8028. The maximum holding time will be 24 hours.

Fluoride
Will be tested using Hach Method 8029 (US EPA method 340.1). The maximum holding time will be 7 days.

Nitrate plus Nitrite Nitrogen
Nitrate plus Nitrite Nitrogen will be analyzed by the UNL Water Science laboratory using the Cd-reduction method (Standard Method 4500-N). The maximum holding time allowed for unpreserved samples is 24 hours.

E. coli
E. coli samples will be analyzed by using the coli-lert-QT (quanti-tray method). Duplicate samples will be sent to the State of Nebraska Health and Human Services Laboratory.

Total Suspended Solids

Will be measured following Standard Method 2540. The maximum holding time allowed for solids samples is 7 days.

Suspended Sediment Concentration
Will be measured following methods outlined in sources like Gray et al. (2000) Water Resources Investigations 00-419. The maximum holding time allowed for solids samples is 7 days.

Turbidity
Will be tested using Standard Methods 2130. The maximum holding time will be 8 hours.

Conductivity
Will be tested using Standard Methods 2510 using a probe. The maximum holding time will be 24 hours.

Dissolved Oxygen
Will be tested using Standard Methods4500-O (Winkler method). The maximum holding time will be 8 hours.

Ammonia
Will be analyzed by the UNL Water Science laboratory using Standard Method 4500-NH_3. The maximum holding time for unpreserved samples will be 24 hours.

Total Kjeldahl Nitrogen
Total Kjeldahl nitrogen (TKN) will be analyzed by the UNL Water Science laboratory using EPA Method 351.3. This method can be used to measure TKN concentrations between 0 - 150 mg/L. The maximum holding time allowed for unpreserved samples is 24 hours.

Chemical Oxygen Demand (COD)
COD will be analyzed using the dichromate methods (Standard Method 5220) and has a maximum holding time of 7 days, after nearly immediate sample acidification.

Total and soluble Phosphorous
Total Phosphorous will be analyzed according to Standard Method 4500-P. Samples for both total phosphorous may be sent to the UNL Water Science laboratory for analysis. Selected samples with high levels of phosphorous will be analyzed for ortho(soluble) phosphate. The maximum holding time is 24 hours.

Temperature
The temperature of the grab samples will be measured in the field using an alcohol thermometer with 1°C temperature increments following Method 2550 from Standard Methods. The thermometer will be allowed to equilibrate and will be recorded to the nearest degree on the Chain of Custody sheet.

Oil and Grease
Samples for oil and grease will be analyzed by an external laboratory using EPA Method 1664. The maximum holding time allowed for oil and grease samples is 4 days.

Oxygen-18 analysis of nitrate

Oxygen and nitrogen isotope analysis of nitrate will use ion exchange separation of nitrate and conversion to silver nitrate prior to high temperature pyrolysis isotope ratio mass spectrometry Depending on the concentration, between 0.2 and 1 liter of sample will be passed through cation and anion exchange resin Nitrate will be eluted using hydrochloric acid, neutralized with silver oxide, and purified nitrate precipitated for isotope analysis as $AgNO_3$ (Silva et al 2001). Expected precision is ±0.3 to 0.5 per mil. Potential sources will be analyzed directly by pyrolysis stable isotope mass spectrometry.

Nitrogen-15 Isotopes of nitrate and ammonia

Nitrogen isotopes in nitrate and ammonia from fertilizer sources (N-15) are measured by steam distillation after reduction of nitrate using Devardas alloy (Bremner and Keeney, 1965) and conversion of nitrogen to purified nitrogen gas using lithium hypobromite on a high vacuum preparation system (Gormly and Spalding, 1979). Nitrogen gas is collected and analyzed on a dual inlet isotope ratio mass spectrometer.

Oxygen-18 of phosphate

The oxygen isotope composition of orthophosphate will be determined on selected samples using method described by McLaughlin et al 2004. Depending on the concentration, up to 1 liter of sample will be filtered, fortified with magnesium chloride and soluble phosphate precipitated with magnesium hydroxide. Phosphate is purified using ion exchange and reprecipitated as silver phosphate prior to high temperature pyrolysis isotope ratio mass spectrometry (McLaughlin et al 2004). Expected precision is ±0.3 per mil. Potential sources will dissolved, separated by filtration, and the reactive portion analyzed by pyrolysis stable isotope mass spectrometry (McLaughlin et al 2006).

Oxygen-18 of water

Oxygen isotopes (O-18) in water was measured by CO2-equilibration on a GV2003 continuous flow IRMS (Horita et al 1989). Standard reference materials (V-SMOW, GISP, and SLAP) are used for calibration in both methods and working standards are run at a frequency of not less than 5 %.

Averages shall be calculated as an arithmetic mean except bacterial counts which shall be calculated as a geometric mean. All monitoring records (calibration and maintenance records, monitoring records and information, and all reports) will be organized and placed in a location agreeable to the City of Lincoln in case they need to be reviewed in the future. The records will be retained for at least three years after the end of the study.

QA/QC

UNL Civil Engineering (CIVE) will test at least 20 percent of the samples in duplicate (over the project year) to estimate the "relative percentage error" for each analysis performed by UNL CIVE.

UNL Civil Engineering will test at least three travel blank samples for each analysis performed by UNL CIVE. Six laboratory blanks will be analyzed for each parameter during the year.

UNL Civil Engineering will determine the Minimum Detection Limit [MDL] (following Standard Methods for Water and Wastewater Analysis) at the start of the project year for each analysis performed by UNL CIVE.

UNL Civil Engineering will test at least 10 standard samples with known concentrations (over the project year) for each analysis performed by UNL CIVE. A new MDL will be determined using this data.

Records and Field Notes

Field notes will be kept by the UNL sampling team. Field notes will describe: time and date of storm, time interval from last storm, air temperature, wind, description of the storm water (e.g., floating debris, oil sheen), and anything that is observed that could affect sample results. A copy of the "NPDES Form PE – Record of Physical Examination Observations Results" or similar type format, is required to be filled out for each outfall tested. Records of all sampling or monitoring information shall include:

a. the date(s), exact place, time and methods of sampling or measurements,
b. the name(s) of the individual(s) who performed the sampling or measurements,
c. the date(s) the analyses were performed,
d. the individual(s) who performed the analyses,
e. the analytical techniques or methods used,
f. the results of such analyses, and
g. laboratory data, bench sheets and other required information.

In addition, records related to auto sampler, bubbler, and other flow measurement devices will be maintained by UNL.

Reports

A summary report including both the 2008, 2009, 2010 and 2011 data will be supplied by November 10, 2011. Initial analysis will be performed as part of a Masters of Science in Civil Engineering thesis, likely completed in the fall of 2011. The thesis will include the data, methods, correlations between the discrete and continuous monitoring, estimates of pollutant loadings, and preliminary pollutant yield estimates for the two watersheds.

Additional data and analysis will be performed as part of the thesis work of an additional graduate student, with a target completion of winter of 2011/ 2012. The overall publishing goal of the project will be to develop one to two manuscripts to be prepared over the life of the project.

Task Two: Characterization of Lincoln's Dry Weather Storm Drain Discharges

Task Two Overview

The proposed work concerns dry weather storm drain discharge characterization. The monitoring of dry weather flows from storm drains is to provide a field screening analysis for illicit connections and illegal dumping for either selected field screening points, and major storm drain outfalls. Approximately 20% of the storm drain field sampling stations will be monitored during this period covered by this project. This task will consist of three phases as discussed below.

Phase I. Visit Field Sampling Sites, Collect Samples and Record Observations.

1. UNL Civil Engineering will have a team of at least two students visit approximately 50 field sampling sites during the summer of 2011. Each site will be visited at least three days after a measurable rainfall. The field sites to be visited are listed in the "Dry-Weather Stormwater Monitoring for Summer 2010" and additional sites identified by the City of Lincoln by May 15, 2011. No more than 5 additional sites will be added to the list for each summer's monitoring, reflecting new outfall sites in newly developed portions of Lincoln and site to be re-sampled from the previous years.

2. UNL Civil Engineering will provide new information found concerning the storm drain outfalls during sample collection to the City.

3. UNL Civil Engineering will report the following concerning each site:
   - time, day, and weather during site visit, and
   - a narrative description of site appearance (e.g., if it appears that dry weather flows may have occurred).

4. If there is flowing water at a field site, UNL Civil Engineering will
   - collect two grab samples of water during a 24 hour period, with a minimum of 4 hours between samples,
   - prepare a narrative description of the water for the color, odor, turbidity, presence of an oil sheen or surface scum as well as any other relevant observations regarding the potential presence of non-storm water discharges or illegal dumping, and
   - a description of the flow rate.
   - if hazardous materials are discovered the Lincoln Fire Department Hazardous Spills Response Unit should be notified immediately. Illicit discharges or illegal dumping need to be reported immediately to the City of Lincoln and Lancaster County Health Department (LLCHD).
   - significantly above normal pollutant data or pollutant data where an illicit discharge may be suspected will also be reported immediately to the City of Lincoln and LLCHD.

Phase II. Analyze Samples and Perform Quality Control Analyses.

5. The analyses listed in Table 2 will be performed by University of Nebraska-Lincoln on water samples collected from each field site with flowing water. The total phosphorus may be performed by the UNL Water Sciences Laboratory.

6. UNL Civil Engineering (CIVE) will test half the samples in duplicate (over the course of the summer) to estimate the "relative percentage error" for each analysis performed by UNL CIVE.

7. UNL Civil Engineering will test at least 8 travel blank samples (over the course of the summer) for each analysis performed by UNL CIVE.

8. UNL Civil Engineering will determine the Minimum Detection Limit [MDL] (following Standard Methods for Water and Wastewater Analysis) at the start of the summer for each analysis performed by UNL CIVE.

9. UNL Civil Engineering will test at least 10 standard samples with known concentrations (over the course of the summer) for each analysis performed by UNL CIVE. A new MDL will be determined using this data.

Table 2. Summary of Laboratory Analyses

Procedure	Method	Max. Sample Hold Time
Temperature	thermometer	On-site testing
Flow Measurement		On-site testing
pH	Probe	4 hours
Chlorine	Hach 8167 (Std. Methods 4500)	On-site testing
Chloride	Hach 8113	7 days
Total Copper	Std. Methods 3030 with Atomic Absorption	3 months
Detergents / Surfactants	Hach 8028	24 hours
Fluoride	Hach 8029 (US EPA 340.1)	7 days
Nitrate	Hach	7 days
Total Suspended Solids	Standard Method 2540	7 days
Turbidity	Standard Method 2130	4 hours

Phase III. Prepare Final Report.

10. UNL Civil Engineering will prepare a final report summarizing the field notes and water sample analysis data collected in the first three Phases. The final report will include several pages of discussion of the data and engineering suggestions. The final report will include tables that make it easy to compare the 2010 results to those found in previous studies. Computer disks will be attached to the final report containing excel spreadsheets of data. Reports will be presented to the City of Lincoln staff by November 15, 2011 summarizing the summer's dry weather monitoring.

References

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Bremner, J. M. and D. R. Keeney. 1965. Steam distillation methods for determination of ammonium nitrate and nitrite. Anal. Chim. Acta 32: 485-495.

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Kreitler, C. W. (1979) Nitrogen-isotope ratio studies of soils and groundwater nitrate from alluvial fan aquifers in Texas. J. Hydrol., 42, 147-170.

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Silva, S. R.; Kendall, C.; Wilkison, D. H.; Ziegler, A. C.; Chang, C. C. Y.; Avanzino, R. J. (2000) A new method for collection of nitrate from fresh water and the analysis of nitrogen and oxygen isotope ratios. Journal of Hydrology, 228 (1-2), 22-36.

Budget Details

All equipment and supplies purchased by this project by UNL remain the property of UNL. This contract will be initiated as soon as possible after 1) appropriate approval by both UNL and the City of Lincoln, and 2) a qualified UNL student is recruited to carry out the work as specified above. Potentially, a Research Assistant Professor, Dr. Ahmed Hosni, may be paid Dr. Dvorak's budgeted salary for his assistance in providing supervision on the project as Dr. Dvorak serves as an Interim Administrator with UNL. The work will be carried out during the period between the approval date and December 31, 2011. The undergraduate student workers will be part-time students and full-time workers during the summer, thus a rate of 9% for benefits has been applied.

Budget

Personnel	Dry Weather Monitoring	Wet Weather Monitoring	Total
Principal Investigators			
B. Dvorak (Summer Salary: 0.82 mo.)	$5,000	$4,500	$9,500
D. Admiraal (Summer Salary: 0.6 mo.)		$5,750	$5,750
D. Snow (Salary: 0.07 mo.)		$1000	$1000
Subtotal:	$5,000	$11,500	$16,500
Fringe Subtotal x 0.28	$1,400	$3,150	$4,550
Graduate Research Assistant (GRA)	$775	$18,600	**$19,375**
GRA Health Insurance	$89	$1,243	$1,332
Graduate Fringe = GRA salary x .36	$229	$6,696	$6,975
Undergraduate hourly worker	$6,000	$7,000	$13,000
Undergraduate worker Fringe = salary x .09	$540	$675	$1,215
Personnel & Benefits Total	$14,083	$48,569	$62,652
Lab Testing Fees			
Metals and nutrients	$1,000	$3,000	$4,000
E. Coli		$1,000	$1,000
Isotopes		$5,000	$5,000
Materials, Supplies, Equipment Maintenance	$2,000	$6,600	$8,600
Operating (phone, copying, postage)	$100	$400	$500
Travel	$400	$250	$650
TOTAL DIRECT COSTS	**$17,583**	**$64,819**	**$82,402**
Indirect Costs Rate x .10	**$1,758**	**$6,482**	**$8,240**
TOTAL PROJECT COSTS (A-F)	**$19,341**	**$71,301**	**$90,642**

Personnel	Dry Weather Monitoring	Wet Weather Monitoring	Total
Principal Investigators			
B. Dvorak (Summer Salary: 1.0 mo.)	$5,000	$4,500	$9,500
D. Admiraal (Summer Salary: 0.5 mo.)		**$5,750**	**$5,750**
D. Snow (Salary: 0.2 mo.)		$1,000	$1,000
Subtotal:	$5,000	$11,250	$16,250
Fringe Subtotal x 0.28	$1,400	**$3,150**	**$4,550**
Graduate Research Assistant (GRA)	**$775**	$18,600	**$19,375**
GRA Health Insurance	**$89**	$1,243	**$1,332**
Graduate Fringe = GRA salary x .36	**$279**	$6,696	**$6,975**
Undergraduate hourly worker	$6,000	**$7,000**	**$13,000**
Undergraduate worker Fringe = salary x .09	$540	$630	$1,170
Personnel & Benefits Total	$14,083	**$48,569**	**$62,652**
Lab Testing Fees			
Metals and nutrients	$1,000	$3,000	$4,000
E. Coli		$1,000	$1,000
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PROJECT TITLE:	*Development of Storm Water Discharge Pollutant Load Model for Holmes Lake Watershed (Year 4)*
SUBMITTED TO:	Ben Higgins, Project Director Engineering Services Public Works City of Lincoln 901 N. 6th St. Lincoln, Nebraska 68508
APPLICANT INSTITUTION:	The University of Nebraska-Lincoln 312 N 14th Street Alexander Building West Lincoln, NE 68588-0430 Administrative Contact: Julie Poykko-Post Ph: 402-472-6174 Email: jpoykkopost2@unl.edu
PROJECT PERIOD:	January 1, 2011 through December 31, 2011
AMOUNT REQUESTED	$90,642
PRINCIPAL INVESTIGATOR:	Bruce Dvorak, Professor Civil Engineering Department W348 Nebraska Hall University of Nebraska Lincoln, Nebraska 68588-0531

SIGNATURES:

Suzan G Lund Date 9/2/10

Suzan G. Lund, Associate Director, UNL Sponsored Programs

PROPOSAL ACCEPTANCE:

_____ Date_____

Mayor Chris Beutler